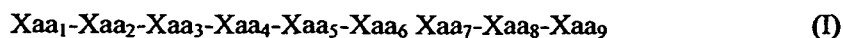


WHAT IS CLAIMED:

1. A composition for inhibiting growth of chondrosarcoma cells comprising an effective amount of a peptide of formula I and a pharmaceutically acceptable carrier:

5



wherein:

10 Xaa₁, Xaa₄, and Xaa₆ are separately each apolar amino acids;

Xaa₂ is a basic amino acid;

Xaa₃ is a cysteine-like amino acid;

Xaa₅ is a polar or aliphatic amino acid;

Xaa₇ is an acidic amino acid;

Xaa₈ is an aliphatic or polar amino acid; and

15 Xaa₉ is an aliphatic, apolar or basic amino acid.

2. A composition for inhibiting growth of chondrosarcoma cells comprising an effective amount of a peptide of formula II and a pharmaceutically acceptable carrier:



wherein:

Xaa₁₀ is a polar, acidic, basic or apolar amino acid;

Xaa₁₁ is a polar or aromatic amino acid;

Xaa₁₂ is a polar, basic, aliphatic or apolar amino acid;

25 Xaa₁₃ is an aromatic, aliphatic, polar or acidic amino acid;

Xaa₁₄ is an aromatic, apolar or polar amino acid;

Xaa₁₅ is an apolar or acidic amino acid;

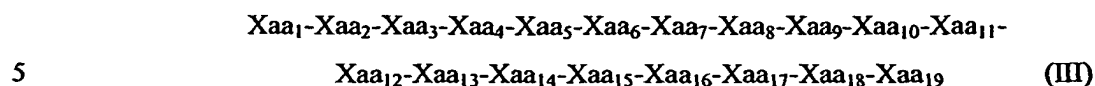
Xaa₁₆ is a basic, a polar or an apolar amino acid;

Xaa₁₇ is a basic, a polar, an aliphatic, an apolar or an acidic amino acid;

30 Xaa₁₈ is an apolar or an aliphatic amino acid; and

Xaa₁₉ is a basic or an aliphatic amino acid.

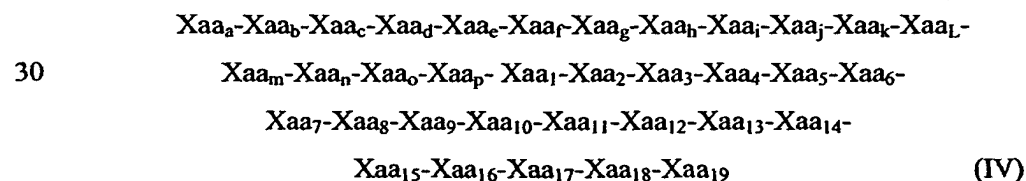
3. A composition for inhibiting growth of chondrosarcoma cells comprising an effective amount of a peptide of formula III and a pharmaceutically acceptable carrier:



wherein

- Xaa₁, Xaa₄, and Xaa₆ are separately each apolar amino acids;
 Xaa₂ is a basic amino acid;
 Xaa₃ is a cysteine-like amino acid;
 10 Xaa₅ is a polar or aliphatic amino acid;
 Xaa₇ is an acidic amino acid;
 Xaa₈ is an aliphatic or polar amino acid;
 Xaa₉ is an aliphatic, apolar or basic amino acid;
 Xaa₁₀ is a polar, acidic, basic or apolar amino acid;
 15 Xaa₁₁ is a polar or aromatic amino acid;
 Xaa₁₂ is a polar, basic, aliphatic or apolar amino acid;
 Xaa₁₃ is an aromatic, aliphatic, polar or acidic amino acid;
 Xaa₁₄ is an aromatic, apolar or polar amino acid;
 Xaa₁₅ is an apolar or acidic amino acid;
 20 Xaa₁₆ is a basic, a polar or an apolar amino acid;
 Xaa₁₇ is a basic, a polar, an aliphatic, an apolar or an acidic amino acid;
 Xaa₁₈ is an apolar or an aliphatic amino acid; and
 Xaa₁₉ is a basic or an aliphatic amino acid.

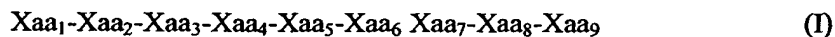
- 25 4. A composition for inhibiting growth of chondrosarcoma cells comprising an effective amount of a peptide of formula IV (SEQ ID NO:18) and a pharmaceutically acceptable carrier:



- | | | |
|----|---|--|
| | Xaa _a is proline; | Xaa ₁ is proline; |
| | Xaa _b is glutamine or glutamic acid; | Xaa ₂ is arginine; |
| | Xaa _c is threonine; | Xaa ₃ is cysteine; |
| 5 | Xaa _d is glycine; | Xaa ₄ is glycine; |
| | Xaa _e is aspartic acid or glutamic acid; | Xaa ₅ is valine or asparagine; |
| | Xaa _f is leucine; | Xaa ₆ is proline; |
| | Xaa _g is aspartic acid; | Xaa ₇ is aspartic acid; |
| | Xaa _h is glutamine or serine; | Xaa ₈ is valine or leucine; |
| 10 | Xaa _i is asparagine or alanine; | Xaa ₉ is alanine or glycine; |
| | Xaa _j is threonine; | Xaa ₁₀ is asparagine or arginine; |
| | Xaa _k is isoleucine or leucine; | Xaa ₁₁ is tyrosine or phenylalanine; |
| | Xaa _L is glutamic acid or lysine; | Xaa ₁₂ is asparagine or glutamine; |
| | Xaa _m is threonine or alanine; | Xaa ₁₃ is phenylalanine or threonine; |
| 15 | Xaa _n is methionine; | Xaa ₁₄ is phenylalanine; |
| | Xaa _o is arginine; | Xaa ₁₅ is proline or glutamic acid; |
| | Xaa _p is lysine or threonine; | Xaa ₁₆ is arginine or glycine; |
| | Xaa ₁₇ is lysine or aspartic acid; | Xaa ₁₈ is proline or leucine; and |
| | Xaa ₁₉ is lysine. | |
- 20
5. The composition of any one of claims 1-4, wherein an apolar amino acid is methionine, glycine or proline.
- 25
6. The composition of any one of claims 1-4, wherein a basic amino acid is histidine, lysine, arginine, 2,3-diaminopropionic acid, ornithine, homoarginine, γ -aminophenylalanine, and 2,4-diaminobutyric acid. The composition of any one of claims 1-4, wherein a cysteine-like amino acid is cysteine, homocysteine, penicillamine, or β -methyl cysteine.
- 30
7. The composition of any one of claims 1-4, wherein an aliphatic amino acid is alanine, valine, leucine, isoleucine, t-butylalanine, t-butylalanine, N-methylisoleucine, norleucine, N-methylvaline, cyclohexylalanine, β -alanine, N-methylglycine, or α -aminoisobutyric acid.

8. The composition of any one of claims 1-4, wherein an acidic amino acid is aspartic acid or glutamic acid.
- 5 9. The composition of any one of claims 1-4, wherein a polar amino acid is asparagine, glutamine, serine, threonine, tyrosine, citrulline, N-acetyl lysine, methionine sulfoxide, or homoserine, or an apolar amino acid such as methionine, glycine or proline.
- 10 10. The composition of any one of claims 1-4, wherein an aromatic amino acid is phenylalanine, tyrosine, tryptophan, phenylglycine, naphthylalanine, β -2-thienylalanine, 1,2,3,4-tetrahydro-isoquinoline-3-carboxylic acid, 4-chlorophenylalanine, 2-fluorophenylalanine, 3-fluorophenylalanine, 4-fluorophenylalanine, pyridylalanine, or 3-benzothieryl alanine.
- 15 11. The composition of any one of claims 1-4 wherein the peptide inhibits proteinase activity of matrix metalloproteinase-1, matrix metalloproteinase-2, matrix metalloproteinase-3, matrix metalloproteinase-4, matrix metalloproteinase-5, matrix metalloproteinase-6, matrix metalloproteinase-7, matrix metalloproteinase-8, and
20 matrix metalloproteinase-9, matrix metalloproteinase-10, matrix metalloproteinase-11, matrix metalloproteinase-12, or matrix metalloproteinase-13.
12. The composition of any one of claims 1-4 wherein inhibiting growth of
25 chondrosarcoma inhibits growth of conventional chondrosarcoma, myxoid chondrosarcoma, mesenchymal chondrosarcoma, clear cell chondrosarcoma, or dedifferentiated (spindle cell) chondrosarcoma.
13. The composition of any one of claims 1-4 wherein inhibiting growth of
30 chondrosarcoma cells inhibits growth of a bone tumor.
14. The composition of any one of claims 1-4, wherein inhibiting growth of chondrosarcoma cells diminishes a size of a bone tumor.

15. The composition of claim 12, 13 or 14, wherein the tumor is metastatic, non-metastatic, vascularized, non-vascularized, hard or soft.
16. The composition of any one of claims 1-4 wherein the peptide comprises SEQ ID NO:1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:5, SEQ ID NO:6, SEQ ID NO:7, SEQ ID NO:8, SEQ ID NO:9, SEQ ID NO:10, SEQ ID NO:11, SEQ ID NO:12, or SEQ ID NO:13.
17. An anti-sarcoma composition that comprises a therapeutically effective amount of peptide that comprises SEQ ID NO:1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:5, SEQ ID NO:6, SEQ ID NO:7, SEQ ID NO:8, SEQ ID NO:9, SEQ ID NO:10, SEQ ID NO:11, SEQ ID NO:12, or SEQ ID NO:13, and a pharmaceutically acceptable carrier, wherein the peptide is capable of inhibiting growth of chondrosarcoma cells.
18. A method for decreasing growth of chondrosarcoma cells that comprises contacting a chondrosarcoma cell with an effective amount of a peptide of formula I:



wherein:

Xaa₁, Xaa₄, and Xaa₆ are separately each apolar amino acids;

Xaa₂ is a basic amino acid;

Xaa₃ is a cysteine-like amino acid;

Xaa₅ is a polar or aliphatic amino acid;

Xaa₇ is an acidic amino acid;

Xaa₈ is an aliphatic or polar amino acid; and

Xaa₉ is an aliphatic, apolar or basic amino acid.

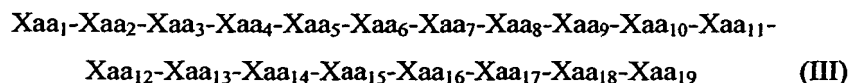
19. A method for decreasing growth of chondrosarcoma cells that comprises contacting a chondrosarcoma cell with an effective amount of a peptide of formula II:



wherein:

- Xaa₁₀ is a polar, acidic, basic or apolar amino acid;
 Xaa₁₁ is a polar or aromatic amino acid;
 5 Xaa₁₂ is a polar, basic, aliphatic or apolar amino acid;
 Xaa₁₃ is an aromatic, aliphatic, polar or acidic amino acid;
 Xaa₁₄ is an aromatic, apolar or polar amino acid;
 Xaa₁₅ is an apolar or acidic amino acid;
 Xaa₁₆ is a basic, a polar or an apolar amino acid;
 10 Xaa₁₇ is a basic, a polar, an aliphatic, an apolar or an acidic amino acid;
 Xaa₁₈ is an apolar or an aliphatic amino acid; and
 Xaa₁₉ is a basic or an aliphatic amino acid.

20. A method for decreasing growth of chondrosarcoma cells that comprises contacting
 15 a chondrosarcoma cell with an effective amount of a peptide of formula III:



wherein:

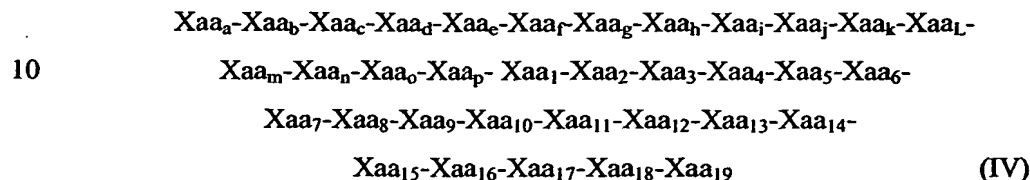
- 20 Xaa₁, Xaa₄, and Xaa₆ are separately each apolar amino acids;
 Xaa₂ is a basic amino acid;
 Xaa₃ is a cysteine-like amino acid;
 Xaa₅ is a polar or aliphatic amino acid;
 Xaa₇ is an acidic amino acid;
 25 Xaa₈ is an aliphatic or polar amino acid;
 Xaa₉ is an aliphatic, apolar or basic amino acid;
 Xaa₁₀ is a polar, acidic, basic or apolar amino acid;
 Xaa₁₁ is a polar or aromatic amino acid;
 Xaa₁₂ is a polar, basic, aliphatic or apolar amino acid;
 30 Xaa₁₃ is an aromatic, aliphatic, polar or acidic amino acid;
 Xaa₁₄ is an aromatic, apolar or polar amino acid;
 Xaa₁₅ is an apolar or acidic amino acid;
 Xaa₁₆ is a basic, a polar or an apolar amino acid;

Xaa₁₇ is a basic, a polar, an aliphatic, an apolar or an acidic amino acid;

Xaa₁₈ is an apolar or an aliphatic amino acid; and

Xaa₁₉ is a basic or an aliphatic amino acid.

- 5 21. A method for decreasing growth of chondrosarcoma cells that comprises contacting a chondrosarcoma cell with an effective amount of a peptide of formula IV (SEQ ID NO:18):



wherein:

- | | | |
|----|---|--|
| 15 | Xaa _a is proline; | Xaa ₁ is proline; |
| | Xaa _b is glutamine or glutamic acid; | Xaa ₂ is arginine; |
| | Xaa _c is threonine; | Xaa ₃ is cysteine; |
| | Xaa _d is glycine; | Xaa ₄ is glycine; |
| | Xaa _e is aspartic acid or glutamic acid; | Xaa ₅ is valine or asparagine; |
| 20 | Xaa _f is leucine; | Xaa ₆ is proline; |
| | Xaa _g is aspartic acid; | Xaa ₇ is aspartic acid; |
| | Xaa _h is glutamine or serine; | Xaa ₈ is valine or leucine; |
| | Xaa _i is asparagine or alanine; | Xaa ₉ is alanine or glycine; |
| | Xaa _j is threonine; | Xaa ₁₀ is asparagine or arginine; |
| 25 | Xaa _k is isoleucine or leucine; | Xaa ₁₁ is tyrosine or phenylalanine; |
| | Xaa _L is glutamic acid or lysine; | Xaa ₁₂ is asparagine or glutamine; |
| | Xaa _m is threonine or alanine; | Xaa ₁₃ is phenylalanine or threonine; |
| | Xaa _n is methionine; | Xaa ₁₄ is phenylalanine; |
| | Xaa _o is arginine; | Xaa ₁₅ is proline or glutamic acid; |
| 30 | Xaa _p is lysine or threonine; | Xaa ₁₆ is arginine or glycine; |
| | Xaa ₁₇ is lysine or aspartic acid; | Xaa ₁₈ is proline or leucine; and |
| | Xaa ₁₉ is lysine. | |

22. The method of any one of claims 18-21, wherein the peptide comprises SEQ ID NO:1, SEQ ID NO:2, SEQ ID NO:3, SEQ ID NO:4, SEQ ID NO:5, SEQ ID NO:6, SEQ ID NO:7, SEQ ID NO:8, SEQ ID NO:9, SEQ ID NO:10, SEQ ID NO:11, SEQ ID NO:12, or SEQ ID NO:13.
- 5
23. The method of any one of claims 18-21, wherein the peptide comprises SEQ ID NO:11.
24. The method of any one of claims 18-21, wherein an apolar amino acid is methionine, glycine or proline.
- 10
25. The method of any one of claims 18-21, wherein a basic amino acid is histidine, lysine, arginine, 2,3-diaminopropionic acid, ornithine, homoarginine, α -aminophenylalanine, and 2,4-diaminobutyric acid.
- 15
26. The method of any one of claims 18-21, wherein a cysteine-like amino acid is cysteine, homocysteine, penicillamine, or β -methyl cysteine.
27. The method of any one of claims 18-21, wherein an aliphatic amino acid is alanine, valine, leucine, isoleucine, t-butylalanine, t-butylalanine, N-methylisoleucine, norleucine, N-methylvaline, cyclohexylalanine, β -alanine, N-methylglycine, or α -aminoisobutyric acid.
- 20
28. The method of any one of claims 18-21, wherein an acidic amino acid is aspartic acid or glutamic acid.
- 25
29. The method of any one of claims 18-21, wherein a polar amino acid is asparagine, glutamine, serine, threonine, tyrosine, citrulline, N-acetyl lysine, methionine sulfoxide, or homoserine, or an apolar amino acid such as methionine, glycine or proline.
- 30
30. The method of any one of claims 18-21, wherein an aromatic amino acid is phenylalanine, tyrosine, tryptophan, phenylglycine, naphthylalanine, β -2-

thienylalanine, 1,2,3,4-tetrahydro-isoquinoline-3-carboxylic acid, 4-chlorophenylalanine, 2-fluorophenylalanine, 3-fluorophenylalanine, 4-fluorophenylalanine, pyridylalanine, or 3-benzothienyl alanine.

- 5 31. The method of any one of claims 18-21, that further comprises locally administering the peptide to a tumor in a mammal.
32. The method of claim 31, wherein the tumor is metastatic, non-metastatic, vascularized, non-vascularized, hard or soft.
- 10 33. The method of any one of claims 18-21, wherein decreasing growth of chondrosarcoma cells decreases growth of conventional chondrosarcoma, myxoid chondrosarcoma, mesenchymal chondrosarcoma, clear cell chondrosarcoma, or dedifferentiated (spindle cell) chondrosarcoma.